

# Summary Site Environmental Report

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*for Calendar Year 2004*

prepared by  
Environment, Safety, and Health/Quality Assurance Oversight Division  
Argonne National Laboratory





# A Message from the Students

By Hilary Nelson

**H**ave you ever felt like you have no idea what people are talking about when it comes to science? Do you ever feel confused when reading a book that uses big, scary, scientific words? We are here to help you. Here, you can read some useful information about Argonne National Laboratory and actually understand what we are telling you.

We are the students of Mrs. Kathleen Luczynski's Biology II class at Downers Grove South High School in Downers Grove, Illinois, for the 2005-2006 school year. All of us are juniors and seniors who volunteered to do this project.

The purpose of this book is to inform the public about what is going on at Argonne National Laboratory

and how the laboratory's activities affect the surrounding public.

This is useful not only for the citizens that live in the area surrounding Argonne, but for us students as well. It is our goal as students to learn more about science. Illinois State Goal 12 is to "understand the fundamental concepts, principles and interconnections of the life, physical and earth/space science." It is the goal of our Biology II class to "use our own experiences, prior knowledge, technology, and research techniques to make decisions about contemporary biological issues." We also deal with research questions designed for students who wish to study new emerging issues in the biological sciences in a challenging learning environment. ►



*Back row, from left to right are Erin Wilson, Jennifer Palumbo, Caitlin Kremer, Tricia Mann, Kevin Coffee, Anna Dean, Jessica Dehlin, Sean Wunderlich, Zack Bell, Catherine Kouba, Danielle Jandris and Sonali Gupta. In the front row, left to right, are Tara Smith, Neha Dharia, Jenn Scinto, Mrs. Kathleen Luczynski, Lindsay Sarno, Amanda Birth, Patricia Sabater, Jane Schrage, Angelica Rangel and Hilary Nelson. Not pictured: Amy Wysocki.*

# Table of contents

A Message from the Students .....	2	Groundwater .....	8
What is Argonne? .....	3	Radiation in General .....	9
Current Research .....	4	Argonne's Radiological Program .....	10
Environmental Monitoring in General .....	5	Non-radiological Waste .....	11
Air Monitoring .....	6	Wildlife Management .....	12
Surface Water .....	7	High School Science Education at Argonne .....	13

## Message

(Continued)

### Creation

The creation of this book is part of our course. Twenty-two of us volunteered to be a part of the project. To prepare for the project, we took a field trip to Argonne on Thursday, September 25, 2005. There we talked with several scientists and saw the site for ourselves. For several weeks we did outlines of the Argonne Site Environmental Report to enhance our knowledge of the material in it. To begin, we picked out certain topics in the report to focus on. We chose the topics we felt were most important. We then rewrote the information in a way that everyone could understand what the science was about. During the creation of this book, we kept in touch with a scientist, Dr. Norbert Golchert, and a science writer, David Baurac, from Argonne. They helped us along and corrected our mistakes in every draft we sent them.

All of our information came from the "Argonne National Laboratory Site Environmental Report" for the year 2004. It was all this information that we condensed and rewrote. Any additional information came from the Internet. All of our sources were cross-referenced to ensure the most current and correct information. Our Web sites were evaluated to make sure they came from reliable sources.

You may wonder why a bunch of high school kids

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*All of our information came from the  
"Argonne National Laboratory Site  
Environmental Report" for the year 2004.*

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chose to partake in this project. "I chose to do it because this was a completely different project than we've ever done before," said senior Caitlin Kremer.

We also want to make it clear that the process of making this book was not an easy one.

"At first it was overwhelming to get a book so filled with information and to be expected to write 700 words on a section. But when you realized to just simplify and summarize, it came easy," said senior Patricia Sabater. "At first it was a lot of work, but it was rewarding in the end," said junior Jennifer Palumbo. We all hope you appreciate the hard work we put into this book.

We, the students, would like to acknowledge and thank everyone who made this book possible. This includes the Argonne staff who helped us through the process, Dr. Norbert Golchert and David Baurac. We would also like to thank the head of the Science Department at Downers Grove South, Mr. Robert Bruns, for helping us along the way and showing his support in this project. Finally, we would like to thank our amazing Biology teacher, Mrs. Kathleen Luczynski for her undying confidence in us and her extreme enthusiasm towards this project.

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For more information about Argonne's Site Environmental Report, contact Norbert Golchert at (630) 252-3912 or [ngolchert@anl.gov](mailto:ngolchert@anl.gov). For more information about Argonne and its programs, visit the laboratory's World Wide Web site at [www.anl.gov](http://www.anl.gov) or contact Communications & Public Affairs at (630) 252-5575. Photos by George Joch. The text was edited by David Baurac. Design and layout by Dave Jacqué.

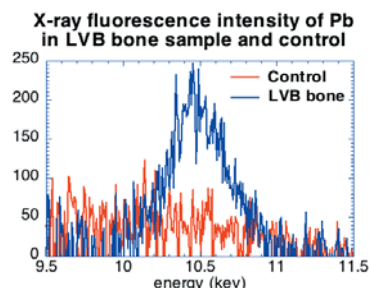
*Argonne is a U.S. Department of Energy laboratory managed by the University of Chicago*



# What Is Argonne?

By Jennifer Scinto and Amy Wysocki

**H**ave you ever wondered how Beethoven died, or who would even want to research such a question? Well, the people who work at Argonne National Laboratory studied such a case.



Argonne came to the conclusion that Beethoven died of severe lead poisoning.

Argonne does a lot of research on topics that affect our every day lives, such as energy. Argonne is a large research center

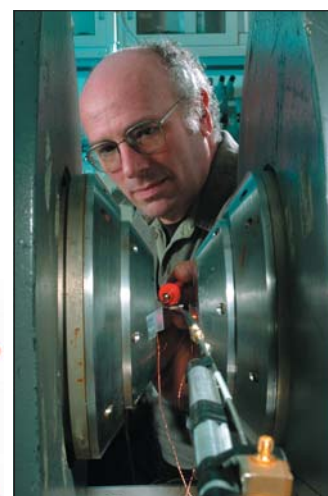
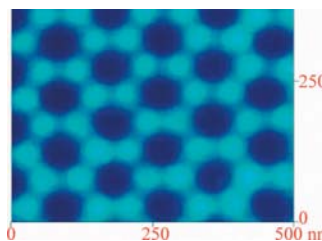
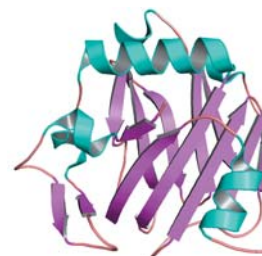
managed by the University of Chicago for the U.S. Department of Energy (DOE). Argonne was founded in 1943 and became our nation's first national laboratory in 1946.

So, where is Argonne you may ask? Argonne National Laboratory is located in Illinois. It occupies 1,500 acres in DuPage County, just south of I-55 and about 25 miles southwest of Lake Michigan. Argonne's site is partially wooded with streams and small ponds. Argonne is the home to many types of animals and plants. For example, the white-tailed deer live there, and plenty of oak trees grow there.

Argonne does a lot of research and development. Research in the basic energy sciences includes physics, chemistry, material science, biology and medical science, and math and computer science. Environmental research includes energy-related carcinogens, atmospheric and climate science, and environmental clean-up technologies. Energy research includes the different types of nuclear and non-nuclear energy sources, including advanced transportation systems, batteries and fuel cells.

Argonne also designs builds, and operates national user facilities for DOE. These are large, one-of-a-kind facilities where scientists come from all over the world to conduct research they cannot carry out anywhere else. Argonne's user facilities provide innovative and effective tools and solutions to energy and environmental challenges to our national and global well-being.

Argonne has more than 2,900 employees and more than 5,000 facility users. About 1,000 of Argonne's employees are engineers and scientists, and about 600 hold doctorate degrees.



# Current Research

By Amanda Birth and Jane Schrage

With about 200 different research programs, Argonne National Laboratory is one of the U.S. Department of Energy's largest multipurpose science laboratories.

Argonne is made up of more than 20 research divisions, where some of the nation's most advanced research is done. Environmental programs include environmental assessments, environmental impact statements, and research aimed at preventing pollution, restoring contaminated sites, and learning more about global climate change. In the physical sciences, Argonne conducts research in physics, material science, mathematics and computer science, structural biology, chemistry and high energy physics. Energy research at Argonne includes nuclear engineering, advanced batteries and fuel cells, and the Transportation Technology R&D Center.

## Scientific user facilities

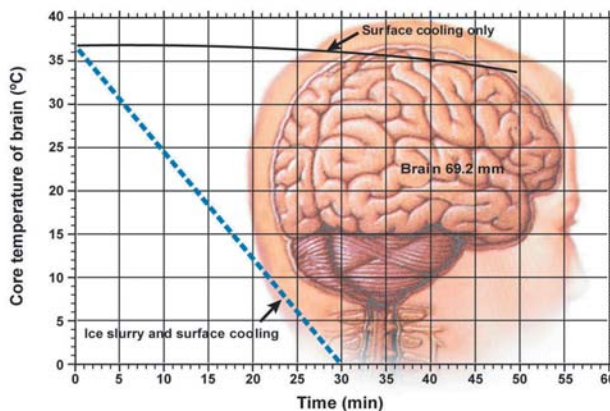
In addition to conducting research, Argonne designs, builds and operates scientific user facilities — large, one-of-a-kind research facilities that are available to researchers from industry, academia and other government laboratories. In general, these user facilities do not charge a fee when research results are to be published. A cost-recovery fee is usually charged when the results are kept private. The research at Argonne has taken many steps in furthering our country's science and engineering, as well as making great strides in basic biological and medical research.

One of the best known scientific user facilities at Argonne is the Advanced Photon Source (APS), the Western Hemisphere's most brilliant source of X-rays for research. The APS has advanced pharmaceuticals, the evolution of combustion engines and microcircuits, and also nanotechnologies.

Argonne's newest user facility is the center for Nanoscale Materials. The research done in this facility deals with materials and properties at the nanoscale level, one-billionth of a meter.

## Cooling project

One current research collaboration between Argonne researchers and doctors from the University of Chicago Hospitals is developing a method to save the lives of stroke and heart attack victims. The researchers have developed an ice slurry that consists of small, smooth ice particles suspended in a saline solution. This ice slurry can be injected into the victim's lungs to cool the blood. As the cooled blood is pumped through the body, it cools the brain and gives doctors more time to save the patient before brain cells start to die from lack of oxygen. The ice slurry method is more effective than surface cooling because it only takes a matter of minutes to cool the organ instead of 3-5 hours. This time difference can have a



huge impact on survival levels of stroke and cardiac arrest victims.

## The Beethoven Project

One of the most talked-about recent projects at Argonne is "The Beethoven Project." By using powerful X-ray beams at the Advanced Photon Source to examine six of Beethoven's hairs and a few pieces of his skull,



scientists determined that the famous composer died of lead poisoning. The methods developed to examine Beethoven's hair and skull are now being used to study the use of bacteria to clean up radioactively contaminated soil and to examine brain cells from

autistic and Alzheimer's patients.

For more information about Argonne research, visit the Argonne home page at [www.anl.gov](http://www.anl.gov).

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# Environmental Monitoring in General

By Angelica Rangel

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The Department of Energy (DOE) and regulatory agencies establish the environmental standards for Argonne National Laboratory to follow and live up to. Argonne has done a wonderful job in keeping its permits up to date and is capable of handling every aspect of safety throughout the facility and its surroundings. In connection with environmental monitoring, Argonne is required to practice sound stewardship and be protective of the air, water, land and other natural resources that its operations could impact.

## Environmental monitoring basics

Argonne's environmental monitoring program covers all the experiments, facility operations, and construction activities that DOE and the Illinois Environmental Protection Agency require to assure that Argonne's activities are conducted in an environmentally safe and sound manner. The environmental monitoring program also helps Argonne evaluate what operations most impact the environment. The environmental monitoring team monitors air emissions, water effluents, drinking water, waste management, and long-term environmental stewardship.

Regulations and laws play a large role in environmental monitoring; Argonne has many programs to assure compliance and to monitor and minimize the impact of the laboratory's operations on the environment. DOE specifically requires an "Environmental Protection Program," to ensure that Argonne's planning actively considers public health, resource protection law, regulations, and DOE requirements.

## Environmental monitoring in-depth

Argonne monitors air on and off site for total alpha activity, beta activity, strontium, thorium, uranium, and plutonium. There were no differences in the air between on-site and off-site results. Sawmill Creek, a small stream that flows across Argonne, was also monitored for nonradiological constituents to comply with Illinois water quality standards; Sawmill Creek water was found to be well within safe environmental standards. Wells on the Argonne site were monitored, screened, and tested; all aspects were covered to comply with the monitoring program.

Environmental monitoring is conducted by

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*Argonne has many programs to assure compliance and to monitor and minimize the impact of the laboratory's operations on the environment.*

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trained Argonne employees. Argonne tracks, identifies, and documents training requirements for each employee.

## Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA) ensures that facilities like Argonne treat, store, and dispose of hazardous waste, in a way that is not harmful to humans or the environment. RCRA also covers the management of underground storage tanks containing hazardous materials or petroleum. The Illinois Environmental Protection Agency (IEPA) is charged with ensuring compliance with most of the RCRA program. The IEPA issued a RCRA Part B Permit to Argonne that took effect on Nov. 4, 1997.

## Argonne's overall compliance

Argonne's environmental monitoring program has many aspects. Some important ones include:

- Air pollutants are regulated under the Clean Air Act. Argonne sends regular reports to the U.S. Environmental Protection Agency

- Compliance with the Clean Water Act is achieved through the National Pollutant Discharge Elimination System permit program, which establishes allowable standards for discharging waste water into waterways.

- Compliance with DOE orders is achieved through regular meetings with and reports to the DOE's Argonne Site Office.

## What was learned from environmental monitoring

Argonne is a very thorough facility and is very serious, with good reason because many of Argonne's programs and experiments can be hazardous. But thankfully the laboratory takes all the proper precautions and follows all the rules and regulations set by the DOE.



# Air Monitoring

By Neha Dharia and Tara Smith

**D**id you know that you will probably breathe in and out about 50 million times in your life? Are you aware that you will take in four hundred gallons of air today alone? With so much air entering our bodies, we really have to think about its quality! Hazardous chemicals in the air can have a huge effect not only on the environment, but on us, as well. Argonne National Laboratory acknowledges the importance of air monitoring and works to comply



*Argonne's Mark Kamiya (foreground) leads Downers Grove South High School students on a tour of Argonne's several habitat restoration areas.*

with environmental acts to ensure maximum protection of surrounding natural resources. Air monitoring is one of the many ways Argonne protects the environment.

The Clean Air Act is a federal law that sets limits on how much pollution may be released into our air. This law determines emission limits and operating criteria for certain hazardous air pollutants. Under the Clean Air Act, Argonne provides the Illinois Environmental Protection Agency with information that describes how the laboratory will ensure compliance with the air quality standards for stationary sources. Argonne must pay annual fees based on regulated air pollutions.

Air monitoring is the sampling and measuring of pollutants present in the atmosphere. Argonne's policy is to conduct all activities in a way that makes protecting the health and safety of the public and of workers a top priority. This also includes environmental protection.

Ambient air is monitored because it is a vital part of our lives. Argonne's research and daily operations sometimes produce harsh emissions that have to be monitored and controlled throughout the Argonne site. Weekly air samples are collected and tested; yearly samples are averaged and used to assess Argonne's compliance with air quality regulations.

Asbestos is a flame-resistant, fibrous material widely used in the past for fireproofing and insulation. These small fibers are easily inhaled or swallowed, causing a number of serious diseases, including Asbestosis, a chronic lung disease that makes breathing more and more difficult, and mesothelioma, a cancer of the membranes that line the chest and abdomen. Many buildings at Argonne contain large amounts of asbestos-containing material. Argonne removes this material as necessary during renovations or maintenance of equipment and facilities. The removal and disposal of this material are governed by the National Emission Standards for Hazardous Air Pollutants (NESHAP), which covers 188 hazardous materials. Asbestos-containing materials are removed from buildings and properly disposed of either by people at Argonne who are trained for the job or by people who work outside of Argonne for large insulation removal projects.

# Surface Water

By Sean Wunderlich and Tricia Mann

Water is crucial to our lives. Without water, life would cease to function. Water is everywhere in our body, including our cells, which contain 90 percent water; overall, our bodies are more than 75 percent water. Because of the importance of water, the government and Argonne National Laboratory work hard to protect and regulate the surface water on and around the Argonne site.

## Laws, acts, and quality standards

The Water Quality Act of 1972 was modified in 1977 and later in 1987 to become commonly known as the Clean Water Act (CWA). This act regulates and monitors the discharge of pollutants into America's surface water. The CWA's main goal is to ensure "fishable and swimmable" water throughout the nation; to fulfill this goal the CWA established rules, regulations, and limits for the types and amounts of chemicals allowed to be released into our waterways. The CWA also established the National Pollutant Discharge Elimination System (NPDES), a regulatory mechanism to help meet these goals.

## Compliance

Argonne complies with numerous laws, acts, and quality standards set by the federal and state governments. Overall, Argonne has a successful history of meeting set standards. Out of 1,600 tests taken in 2004, Argonne exceeded regulatory limits only four times. Specially trained Argonne employees monitor the surface water by obtaining samples for analysis from ponds, streams and creeks on the Argonne site. One of the main water samples taken is from Sawmill Creek. Sampling periods range from twice a day to twice a month, depending on the time of year, the weather and the specifics of the location. This sampling and analysis help to ensure the safety and quality of the water for the people on and off the Argonne site.

## Sources of Possible Contaminates

Numerous contaminants could make their way into on-site water from the laboratory's research activities. Possible

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contaminants include radionuclides — such as uranium and plutonium — total dissolved solids (dissolved salts), and metals. If and when these contaminants appear in Argonne's water, they can usually be traced back to an accidental release or other factors beyond Argonne controls (see chart below).

## Findings

Argonne failed to meet CWA standards on only four occasions during 2004. Three of the four situations occurred at a discharge outfall from the laboratory's Wastewater Treatment Plant and Equalization Pond when the levels of Total Dissolved Solids (dissolved salts) were temporarily higher than permitted. The main source of the dissolved solids was runoff from the coal piles and winter salt from icy roads and parking lots. Argonne has taken steps to try to reduce the winter peaks of dissolved solids at the outfall by connecting to the DuPage County sewer system. The laboratory's fourth water quality exceedance came from occasional high chlorine levels from chlorinated drinking water and from cooling tower blow down. To address this problem, Argonne has redirected many chlorinated water discharges for processing at its Wastewater Treatment Plant.

Summary of 2004 Water Effluent Exceedances

Date	Outfall	Parameter	Assessment
01/15/04	NA <sup>a</sup>	NA	Unpermitted release to surface water from rupture of a treated canal water pressure main
02/10/04	001	TDS	Salt associated with snowmelt infiltration/inflow
02/24/04	001	TDS	Salt associated with snowmelt infiltration/inflow
03/02/04	001	TDS	Salt associated with snowmelt infiltration/inflow

<sup>a</sup> NA = not applicable.



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# Groundwater

By Erin Wilson and Zack Bell

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**D**o you know that there are more than 50 chemicals and other abiotic factors (pH, temperature, etc.) in groundwater that can lead to problematic health concerns such as cancer? It is important that Argonne National Laboratory be in compliance with federal laws pertaining to groundwater monitoring in order to ensure public awareness, safety, and health.

## What is groundwater?

Groundwater is found in aquifers — cracks and spaces in soil, sand and rock. Groundwater is the primary source of water for industry and nature and many people. Fifty percent of the United States uses groundwater for domestic purposes, such as drinking and washing. Groundwater is naturally refilled in wells by rain and snow. Since 1997, Argonne's domestic water supply has come from Lake Michigan. This water has low bicarbonate levels that don't corrode or decay the laboratory's piping systems. Argonne still maintains four wells in case of a loss of Lake Michigan water.

## How do I know my water is safe?

Argonne has a responsibility to control the levels of contaminants in its groundwater and to protect neighboring communities from pollutants in the lab's groundwater. Therefore Argonne monitors and analyzes its groundwater for radioactive substances, toxic chemicals, and volatile organic compounds (VOCs), such as cleaning fluids.

## Has Argonne complied with the law?

The Safe Drinking Water Act (SDWA) ensures that the drinking water supplied to the public is free of contaminants. The Environmental Protection Agency (EPA) sets national drinking water standards that water system providers must follow. Argonne is in compliance with the SDWA.

The lab provides an annual report to verify monitoring and to ensure regulatory agencies that all measured contaminants meet the drinking water standards. In areas 317/319, just inside Argonne's southern fence, 25 extraction wells intercept the flow of polluted groundwater off the Argonne site. An ongoing monitoring program measures contamination in Argonne's groundwater.

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## How is it monitored?

Argonne uses various instruments to capture and analyze on-site groundwater. Scientists use bladder pumps to bring the groundwater to the surface, so they can measure its volume, depth, conductivity, temperature and pH in numerous groundwater wells at Argonne. The laboratory has adopted prevention and conservation routines by following the SDWA and CWA in order to prevent groundwater supplies from being contaminated.

Scientists at Argonne tested samples of groundwater quarterly in 2004. Data collection and analysis are part of Argonne's long-term environmental stewardship program. These samples were tested for VOCs, alpha and beta radioactivity, strontium-90, and hydrogen-3; each test complied with federal regulations. Part of the long-term stewardship program includes close examination of the areas of concern known as 317/319; 317 is a former radioactive waste storage area, while 319 contains an inactive landfill. The groundwater below area 317 contains VOCs, such as cleaning solvents; however, consumers do not drink this water. Measurable concentrations of hydrogen-3 and strontium-90 exist in the 319 area groundwater. Fortunately, the Argonne scientists are using willow and poplar trees to suck the bad chemicals out of the water. This process is known as phytoremediation. Phytoremediation is when woody and herbaceous plants separate water and chemical substances from subsurface groundwater. These trees then decompose the VOCs and transpire the water into the atmosphere.

## Conclusion

Overall, Argonne's commitment to the Clean Water Action Plan Program continues to be successful. Argonne's goals include reducing public health threats, conserving natural resources, controlling pollutants, and making sure public water quality is as high as possible.

# What Is Radiation?

By Anna-Marie Dean and Jessica Dehlin

**R**adiation is energy that originates from a specific source that travels through space. Radiation must be treated carefully and with respect, because it can cause harm. Radiation is monitored using special instruments.

## What are some types of radiation?

There are three basic types of radiation:

- Alpha rays are the largest and slowest. They are emitted from the nucleus of an atom and are easily stopped first by material as thin as a tissue.

- Beta rays are slightly smaller and faster than alpha rays and can pass through many more layers of tissue.

- Gamma rays are the smallest and fastest and can penetrate the farthest. The sources of radiation are man-made and natural radiation.

Man-made radiation is common, and you might not even be aware of all the products you use that contain radiation. To name a few: radiation in medicine, X-rays, cancer treatments, nuclear power reactors, tobacco, TVs, smoke detectors, lanterns, building materials, radiography, and some research laboratories. On the other hand, natural radiation is found in the soil, water, vegetation, and even in the air naturally.

## How is radiation monitored?

Radiation is monitored several different ways; two common radiation-monitoring instruments are dosimeters and small active radiation monitors. Dosimeters measure radiation exposure to humans, especially workers whose jobs involve radiation or radioactive materials. A dosimeter is a small strip of film that is worn to record the amount of radiation a person is exposed to. The small active radiation monitor is used in space to detect radiation coming from the Earth. As the chart at left shows, people who live in different cities are exposed to different amounts of natural radiation because of natural variations in cosmic and terrestrial radiation.

## Conclusion

Radiation is a necessity for many everyday things, such as cancer treatments and X-rays. Although we use radiation daily in our lives, it can put our health and futures at risk if we do not handle it carefully and treat it with respect.



*Argonne has developed a process that in one step converts spent commercial nuclear fuel, which is a ceramic oxide, into metal. The product can then be treated with Argonne's electrorefining technology to recover the uranium and transuranic elements for recycling into new fuel. Using a glovebox to protect herself from radiation, Argonne chemist Laurel Barnes prepares for a test of the metal-oxide conversion process.*

## Average Natural Background Radiation in Selected United State Cities (excluding radon)

City	Radiation (mrem/yr)
Las Vegas, NV	69.5
Denver, CO	164.6
Tampa, FL	63.7
Portland, OR	86.7
Los Angeles, CA	73.6
St. Louis, MO	87.9
Rochester, NY	88.1
Wheeling, WV	111.9
Richmond, VA	64.1
New Orleans, LA	63.7



# Radiological Monitoring

By Caitlin Kremer and Jennifer Palumbo

Radiation sounds like a scary word when one first hears it, but with radiation programs like the one at Argonne National Laboratory, the community's safety comes first. Argonne is home to research and experiments that are known nationally and that also involve dangerous chemicals and even radiation. Argonne works hard to safely use and dispose of all chemicals and radiation.

## Compliance

Radioactivity at Argonne National Laboratory is primarily transported by air and water. Therefore, radionuclide emissions from Argonne National Laboratory facilities are regulated under the Clean Air Act and the Clean Water Act. Argonne complies with the National Pollutant Discharge Elimination System that regulates water pollution under the Clean Water Act. The dose rates of all radionuclides were all well below the safety standards for the general population.

## Radiation in the air

One way that radiation is spread is through the air. Argonne collects air samples for analysis from particle samplers at 13 locations on its site and six off site. The particle samplers' filters are changed weekly by Argonne scientists, and the filters' contents are analyzed to make sure that radiation emitted is within the safe regulatory limit. Argonne staff collect filters on site, while cooperating agencies collect filters off site and mail them to Argonne to be analyzed. Off-site results are compared to on-site results to be sure Argonne has not added any radioactivity to the environment.

## Radiation in the water

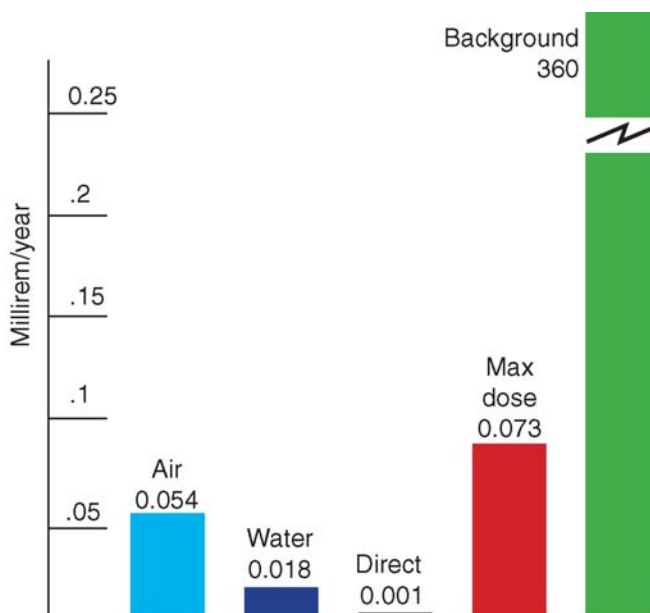
Another way that radiation can spread is through water. The only significant location where Argonne found water-borne radionuclides was in the off-site water of Sawmill Creek. The radionuclides enter the water from the disposal of liquid. To measure the radioactivity in the water, Argonne collects the liquid in retention tanks. When a tank is full, it is sampled and thoroughly analyzed for radioactivity. Since Sawmill Creek is not used for drinking, swimming, or boating, the radioactivity in the water does not directly affect the people surrounding Argonne; but Sawmill Creek still needs to be monitored, because it empties into the Des Plaines River. The river is

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*A hypothetical individual who drank water from Sawmill Creek would receive only about 0.02 mrem/yr of radiation exposure, which is about 5,000 times lower than the maximum allowable safety limit.*

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sampled once a month above the creek outfall and twice a month below it to see how the radioactivity in the creek affects the river. A hypothetical individual who drank water from Sawmill Creek would receive only about 0.02 mrem/yr of radiation exposure, which is about 5,000 times lower than the maximum allowable safety limit. With proper monitoring by Argonne, the levels of radiation in the water can be kept low and harmless to the surrounding community.



*This chart shows the estimated radiation dose to a hypothetical person who received the maximum air and direct exposure from Argonne operations, and used only water from Sawmill Creek below the laboratory's wastewater discharge. Background radiation comes from natural sources, like cosmic rays and radon, and medical sources like dental X-rays.*

# Non-Radiological Waste

By Patricia Sabater and Kevin Coffee

**S**olid waste can drastically affect our environment. If it is not treated correctly, monitored, and controlled, it can be as harmful as radiological wastes. Argonne keeps a close eye on the production of solid waste on its site.

The United States as a whole invests millions of dollars to establish landfills to hold the piles of garbage generated everyday. Because landfills can fill up in a



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*Argonne recycles much of its solid waste, and what cannot be recycled is disposed of by licensed commercial waste management companies.*

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matter of years, new landfills are developed to prevent the underground water supply from being polluted.

Today, Argonne recycles much of its solid waste, and what cannot be recycled is disposed of by licensed commercial waste management companies. But much of the solid waste produced at Argonne before 1992 was disposed of in landfills on the Argonne site. If these retired landfills are not monitored, they could leak harmful wastes into surrounding environment or water supply. If these wastes were to enter the water, they could affect the public health in surrounding communities.

## **Production of solid waste**

Argonne produces many types of solid waste, including non-hazardous special wastes, certified non-special waste, and toxic substances. Non-radiological waste is produced in offices, the employee cafeteria, and other locations around the site.

## **Monitoring solid waste**

Each of Argonne's three closed landfills is covered by a water-impervious cap to keep precipitation from seeping into the landfill and leaching contaminants into the groundwater. Forty-seven wells monitor groundwater for chemical contamination from the landfills. This monitoring is required by the Clean Water Act and the Illinois and U.S. Environmental Protection Agencies to help prevent oil or oil products from being released into the navigable waters of the United States.

## **Sludge treatment**

Argonne's sanitary wastewater system produce sewage sludge from the processing of 360,000 gallons of wastewater each day. This sludge is disposed of at an off-site special landfill.



# Wildlife Management

By Danielle Jandris  
and Lindsay Sarno

Wildlife management is an important part of Argonne's environmental stewardship program and the laboratory's compliance with laws that protect migrating, threatened, and endangered species. Argonne's habitat management program aims to increase the wildlife numbers and biodiversity on its site, to protect major habitats that have not been affected by humans, and to reestablish original conditions in areas that have been changed by humans.



*The "white deer" at Argonne are remnants of a herd owned by the previous owner of the property. They are fallow deer, native to parts of Europe and Asia. There are about 40 of the animals on the site.*



## Endangered species

The Endangered Species Act of 1973 protects plants and animals from the adverse affects of land development. No federally listed threatened or endangered species lives on the Argonne site, but three endangered species reside at Waterfall Glen Forest Preserve, which surrounds Argonne. These are the Hines Emerald Dragonfly, Leafy Prairie Clover, and the Lakeside Daisy. During winter migration, some protected species, such as the Bald Eagle, Piping Plover, and the Least Tern, could briefly inhabit the Argonne site.

## Deer management

Argonne monitors its deer population by taking spotlight surveys to meet the requirements of the laboratory's deer population control permits. To monitor the deer herd's health, Argonne evaluates the animals' dressed weights and the fat stored in their organs. The health of the deer herd has improved since the removal program started in 1995.

## Vegetation

Argonne's 1,500-acre site is mostly forest and prairie. Research and historical photos confirm that about 75 percent of Argonne was actively farmed before the 1940s, and the remaining 25 percent was pasture, open oak, woodlots, and oak forests. As a member of the Chicago Wilderness Coalition, Argonne conducts restoration projects to improve the natural quality of prairies and wetlands on its site.

# High School Science Education at Argonne

By Sonali Gupta and Cathy Kouba

One of Argonne's important missions is to help develop the next generation of scientists and researchers for the nation. With programs for students and faculty at all educational levels, Argonne has the largest science education program of any Department of Energy science laboratory. Many of these programs help high school students.

task was to build the wackiest machine possible that could cut or shred five sheets of 8½-by-11-inch 20-lb paper in 20 or more steps. Argonne's Rube Goldberg contest has been going on for 11 years now. This event takes place at Chicago Children's Museum in Navy Pier. The top three teams advance to the Illinois State Championship.



*High school students in Illinois compete each year to build the wackiest and most complicated machine to perform an assigned task. The event is the Rube Goldberg Contest, sponsored by Argonne.*

## Rube Goldberg contest

Have you ever wanted to test your creativity? Does building crazy machines for fun sound appealing to you? If so, Argonne welcomes you to test your science and engineering design skills in the Rube Goldberg machine contest Argonne sponsors each year. This contest is named after the famous cartoonist, Rueben Goldberg, whose cartoons inspired the weird machines and crazy mechanisms. Teams for this contest consist of two to six high school students and a faculty advisor. This year's

## Science Careers in Search of Women

Women have long been underrepresented in science and engineering, but Argonne is working to change that. Argonne's Women in Science and Technology Program (WIST) is dedicated to helping women get involved at the lab. WIST helps to recruit retain and promote women in the scientific workforce. For 19 years, WIST and Argonne have sponsored an annual Science Careers in Search of Women conference to encourage high school girls to pursue careers in science and technology.

## 'Newton'

To help science students and teachers find answers to scientific questions, Argonne sponsors the "Ask a Scientist" Web site at [www.newton.dep.anl.gov](http://www.newton.dep.anl.gov).

Online visitors can ask science-related questions and get responses from a team of volunteer scientists. Users can also search through an online library of other questions that have been answered.

## Argonne tours

Schools and organizations can tour the Argonne site or participate in hands-on science education programs in Argonne's Learning Lab. In general, children must be at least 16 years of age, but some learning programs are available for younger children.





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The University of Chicago for the U.S. Department of Energy

